REGULATIONS GOVERNING TREATMENT, STORAGE, AND DISPOSAL FACILITIES

OVERVIEW

Treatment, storage, and disposal facilities (TSDF) are the last link in the cradle-to-grave hazardous waste management system. The requirements for TSDFs, located in 40 CFR Parts 264 and 265, are more extensive than the standards for generators and transporters. They include general facility operating standards, as well as standards for the various types of units in which hazardous waste is managed. General facility standards address good management practices for any facility engaged in hazardous waste

management. The technical standards go beyond these requirements to ensure that all elements of the TSDF are constructed and operated to prevent leaks of hazardous waste into the environment. The technical standards also address the diversity of hazardous waste operations being conducted around the country by guiding facilities in the proper design, construction, operation, maintenance, and closure of a variety of hazardous waste treatment, storage, and disposal units. These unit standards include requirements for a wide range of hazardous waste management units, from containers (e.g., 55-gallon drums) to landfills, in order to ensure that these units handle waste safely and effectively.

WHAT IS A TSDF?

With some exceptions, a TSDF is a facility engaged in one or more of the following activities:

- **Treatment** – Any method, technique, or process designed to physically, chemically, or biologically change the nature of a hazardous waste
- **Storage** – Holding hazardous waste for a temporary period, after which the hazardous waste is treated, disposed of, or stored elsewhere
- **Disposal** – The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid or hazardous waste on or in the land or water. A disposal facility is any site where hazardous waste is intentionally placed and where the waste will remain after a TSDF stops operation.

To help owners and operators of new and existing TSDFs comply with new RCRA regulations, RCRA divides them into two categories: permitted (new) and interim status (existing).

■ Permits and Interim Status

When Congress enacted RCRA in 1976, it directed EPA to develop standards for new TSDFs (those built after the standards were established) and for facilities that were already in operation. Congress further required that the standards for both new and existing facilities differ only where absolutely necessary.

New TSDFs, those facilities constructed after the regulations were promulgated, must be designed and built to meet the standards EPA deemed necessary to protect human health and the environment. To handle hazardous waste, a new facility must obtain a permit, in accordance with provisions in 40 CFR Part 270, before it begins operation. These facilities are called **permitted facilities**. (Permitting is fully discussed in Chapter III, Permitting of Treatment, Storage, and Disposal Facilities). The permit lays out the standards and requirements applicable to the specific activities conducted at that facility, including both the general facility standards and the standards applicable to each type of unit at the facility. The requirements for permitted facilities are located in 40 CFR Part 264.

On the other hand, facilities already in existence and operating may not immediately be able to meet the design and operating standards for new facilities. For example, when RCRA was enacted, existing hazardous waste management facilities immediately became subject to regulation, while other existing facilities managing nonhazardous waste were brought into RCRA by regulatory changes that made these wastes hazardous. For both sets of TSDFs, EPA created a special category of regulations to allow these facilities to gradually come up to speed with the standards for permitted facilities. These facilities are called **interim status facilities**. While in interim status, facilities must comply with these separate standards, which are often less stringent than the standards for permitted facilities and are not tailored to individual sites, until they receive their permit. The requirements for interim status facilities are located in 40 CFR Part 265.

While the standards for permitted facilities are often similar to those for interim status facilities, there are circumstances where the standards for new facilities would be impracticable for existing facilities to implement immediately. This chapter will focus primarily on the standards for permitted facilities, contrasting them with the standards for interim status facilities where appropriate.

Exemptions

In order to promote certain beneficial activities or to avoid overlapping with the requirements of other parts of RCRA or other environmental laws, RCRA exempts certain types of facilities or operations from the standards for permitted and interim status TSDFs.

Permits-by-Rule

Facilities that have permits for certain activities under other environmental laws may qualify for a special form of a RCRA permit, known as a **permit-by-rule**. These activities include ocean disposal of hazardous wastes regulated under the Marine Protection, Research, and Sanctuaries Act (MPRSA); underground injection of hazardous wastes regulated under the Safe Drinking Water Act (SDWA); and treatment of hazardous wastewaters in a publicly owned treatment works (POTW) regulated under the Clean Water Act (CWA). Under this exemption, the facility's non-RCRA permit serves in place of a RCRA permit, provided the facility is in compliance with that permit and other basic RCRA administrative requirements. (Permits-by-rule are fully discussed in Chapter III, Permitting of Treatment, Storage, and Disposal Facilities).

Conditionally Exempt Small Quantity Generator Waste

Facilities that treat (including recycle), store, or dispose of only hazardous waste generated by conditionally exempt small quantity generators (CESQGs) are excluded from the TSDF standards. RCRA requires that such facilities be permitted, licensed, or registered by the state to handle nonhazardous industrial or municipal solid waste, or qualify as a recycling facility. (CESQGs are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

Recyclable Materials

RCRA provides separate, reduced regulations for TSDFs recycling certain materials. These recycling facilities are generally exempt from the TSDF standards, but may be required to comply with streamlined hazardous waste management requirements. These reduced provisions apply to facilities recycling:

- Precious metals
- Lead-acid batteries
- Used oil
- Hazardous waste burned in boilers and industrial furnaces.

For other recyclable materials, there are no special requirements. For example, facilities recycling the following materials are exempt from all TSDF standards:

- Industrial ethyl alcohol
- Used batteries returned to the manufacturer for regeneration
- Scrap metal
- Fuels produced from refining oil-bearing hazardous wastes
- Oil reclaimed from hazardous waste.

(Recyclable materials are fully discussed in Chapter III, Hazardous Waste Recycling and Universal Wastes).

Generators

Generators accumulating waste on site in accordance with the generator regulations do not need a permit and do not have to comply with the permitted TSDF standards. They must comply with only those interim status standards specified in the generator regulations. On the other hand, if small quantity generators (SQGs) or CESQGs exceed their respective storage limits, or if large quantity generators (LQGs) or SQGs exceed their respective accumulation time limits, the facility becomes a storage facility subject to all applicable requirements for TSDFs (including permitting). (Generators are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

Farmers

Farmers disposing of pesticide wastes on their own property in compliance with the disposal instructions on the pesticide label are also not

subject to the TSDF standards. Congress did not want to regulate farmers under both RCRA and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Therefore, farmers meeting these management conditions are exempt from the TSDF standards.

Totally Enclosed Treatment Units

Totally enclosed treatment units (TETUs) are designed and constructed to eliminate the potential for hazardous wastes to escape into the environment during treatment. If directly connected to an industrial production process, and treatment prevents the release of hazardous constituents into the environment, TETUs are exempt from the TSDF standards.

Elementary Neutralization Units

Elementary neutralization units (ENUs) are containers, tanks, tank systems, transportation vehicles, or vessels that neutralize wastes that are hazardous only for exhibiting the characteristic of corrosivity (D003). Neutralization in such units is exempt from the TSDF standards. However, neutralization in other types of units is regulated.

Wastewater Treatment Units

Wastewater treatment units (WWTUs) are tanks or tanks systems that treat hazardous wastewaters and discharge them pursuant to CWA (e.g., the discharge is sent to a POTW or to surface water under a NPDES permit). Such units are exempt from the TSDF regulations.

Emergency Response

Treatment, storage, and disposal activities that are part of an emergency response action taken to immediately contain or treat a spill of hazardous waste are exempt from TSDF standards. On the other hand, any treatment, storage, or disposal after the emergency situation has passed is subject to full regulation. Likewise, any hazardous waste generated during an emergency action must be managed in accordance with the generator standards.

Transfer Facilities

A transfer facility is a transportation-related facility, including loading docks and parking and storage areas, where shipments of hazardous waste are temporarily held during the normal course of transportation. A transfer facility temporarily storing a manifested shipment of hazardous waste for less than 10 days before transfer to the next designated facility is not subject to the TSDF standards. On the other hand, if transporter storage at a transfer facility exceeds 10 days, the transfer facility becomes a storage facility subject to all applicable requirements for TSDFs (including permitting). (Transfer facilities are fully discussed in Chapter III, Regulations Governing Hazardous Waste Transporters).

Adding Absorbent

Because liquid hazardous wastes are not allowed in a landfill, absorbents must be added to the container to remove the visible liquids. Adding absorbent to hazardous waste may be considered hazardous waste treatment, thus triggering the TSDF standards. However, to promote the reduction of the amount of liquid hazardous waste sent to landfills, the regulations for hazardous waste treatment do not apply to a facility adding absorbent to waste when the waste is first put into a container. Subsequent addition of absorbent is not covered under this exemption and may be considered treatment subject to the TSDF standards.

Universal Waste Handlers

Handlers and transporters of recycled batteries, pesticides, mercury-containing equipment, and lamps are exempt from the TSDF standards. (Universal wastes are fully discussed in Chapter III, Hazardous Waste Recycling and Universal Wastes).

GENERAL FACILITY STANDARDS

If a TSDF is not exempt under any of these provisions, then it must comply with the standards for fully regulated TSDFs. These standards cover good management practices, including keeping track of the amount and type of wastes entering the facility, training employees to safely manage

hazardous waste, and preparing to avoid hazardous waste emergencies.

■ EPA Identification Numbers

As with generators and transporters of hazardous waste, TSDF owners and operators are required to notify EPA of the types of hazardous waste they plan to treat, store, or dispose of by applying for an EPA identification (ID) number.

■ Waste Analysis

To keep track of the wastes being sent for treatment, storage, or disposal, TSDF owners and operators must analyze waste shipments. The TSDF's permit will list the types of hazardous waste that a facility is allowed to treat, store, or dispose. Analyzing the waste received ensures that the facility only handles wastes they are permitted to handle, and ensures that the wastes are treated, stored, or disposed properly. A **waste analysis plan** outlines the procedures necessary to ensure proper treatment, storage, or disposal. The plan must be written, kept on site, and answer six basic questions:

- How will the TSDF know if the waste received is the same as that described on the manifest?
- Which waste constituents should the TSDF analyze?
- How should samples be taken?
- What type of testing and analytical methods should the facility use?
- How often should the waste be retested?
- What are the acceptance and rejection criteria for each wastestream?

The waste analysis must be repeated periodically to ensure that the information on a given waste is accurate and current. At a minimum, the waste analysis must be repeated when the TSDF is notified or has reason to believe that the process or operation generating the hazardous waste has changed. Waste analysis must also be repeated when inspection indicates that the hazardous waste received does not match the information on the accompanying manifest.

■ Security

Security provisions are intended to prevent accidental or unauthorized entry into the active portion of a facility (i.e., where hazardous waste is treated, stored, or disposed). Unless the TSDF owner and operator demonstrates to the implementing agency that livestock or unauthorized persons who enter the facility will not be harmed and will not interfere with compliance with the regulations, the facility must install the following security measures:

- A 24-hour surveillance system that continuously monitors and controls entry onto the active portion of the facility (e.g., television monitoring, guards)

OR

- An artificial or natural barrier (e.g., a fence) that completely surrounds the active portion of the facility and serves as a means to control entry to the active portion of the facility at all times through gates or entrances
- A sign reading: "Danger — Unauthorized Personnel Keep Out" at each entrance to the active portion of the facility. The sign must be written in English and any other language that is predominant in the area surrounding the facility. Alternative language conveying the same message may also be used.

■ Inspection Requirements

To make sure that the facility is operating properly, the TSDF owner and operator must visually inspect the facility for malfunction, deterioration, operator errors, and leaks. The inspections should follow a written inspection schedule developed and followed by the owner and operator. The schedule identifies the types of problems to be checked and how often inspections should be conducted. Areas where spills are more likely to occur, such as loading and unloading areas, must be inspected daily when in use. Unit-specific inspections or requirements also must be included in

the schedule. The owner and operator must record inspections in a log or summary and must remedy any problems identified during inspections.

■ Personnel Training

TSDF owners and operators must provide training to ensure that employees at the facility understand the risks posed by management of hazardous waste and are prepared to respond in the case of an emergency. The training program must be completed six months from the date the facility is subject to the TSDF standards, or six months after the date a worker is newly employed. This training program must be reviewed annually.

■ Requirements For Ignitable, Reactive, or Incompatible Waste

To avoid dangerous accidents, fires, or explosions, special care must be taken in handling ignitable, reactive, or incompatible wastes. TSDF owners and operators handling ignitable and reactive wastes must be able to demonstrate that these wastes are protected from ignition sources. Such protection includes "No Smoking" signs placed where ignitable and reactive wastes are stored, designation of separate smoking areas, and additional handling requirements. Similarly, owners and operators must take precautions against the combined storage of wastes that might react dangerously with one another, or with the unit in which they are stored. Such a reaction might be a fire or explosion, or the release of toxic dusts, gases, or fumes. To determine if particular wastes or storage units are compatible, the RCRA regulations list some common potentially incompatible wastes (40 CFR Part 264, Appendix V). For compatibility of wastes not listed in the regulations, the owner or operator may need to test the waste and the unit for compatibility.

■ Location Standards

Certain types of terrain may increase the dangers associated with managing hazardous waste. To protect people and the environment around these areas, RCRA imposes restrictions on where TSDFs can be built. The location standards for building new TSDFs include restrictions on siting TSDFs in floodplains or earthquake-sensitive areas. Additionally, TSDF owners and operators may not place noncontainerized or bulk liquid hazardous waste in a salt dome, salt bed formation, or underground mine or cave. Congress has granted one exception to this rule: DOE's Waste Isolation Pilot Project (WIPP) in New Mexico.

PREPAREDNESS AND PREVENTION

The preparedness and prevention standards are intended to minimize and prevent emergency situations at TSDFs, such as a fire, an explosion, or any unplanned release of hazardous waste or hazardous waste constituents to the air, soil, or surface water. These regulations require maintenance and routine testing of emergency equipment, alarms, minimum aisle space (to accommodate movement of personnel and equipment during emergencies), and provisions for contacting local authorities (police, fire department, hospitals, and emergency response teams) involved in emergency responses at the facility.

CONTINGENCY PLANS AND EMERGENCY PROCEDURES

A TSDF must be prepared to respond to unavoidable emergencies. Contingency plans and emergency procedures provide the owner and operator with mechanisms to respond effectively to emergencies. The goal of these requirements is to minimize hazards resulting from fires, explosions, or any unplanned release of hazardous waste or constituents to air, soil, or surface water. To help guide these activities, the owner and operator must maintain a written contingency plan at the facility, and must carry out that plan immediately in the event of an emergency.

■ Contingency Plan

The contingency plan describes emergency response arrangements with local authorities and lists the names, addresses, and telephone numbers of all facility personnel qualified to work with local

authorities as emergency coordinators. Where applicable, the plan might also include a list of emergency equipment and evacuation plans. If the owner and operator has already prepared an emergency or contingency plan in accordance with other regulations (e.g., the Spill Prevention, Control, and Countermeasures (SPCC) rules as discussed in Chapter VI, Legislative Framework for Addressing Hazardous Waste Problems), they can amend the existing plan to incorporate hazardous waste management provisions.

The contingency plan must be reviewed and amended when the applicable regulations or facility permits are revised, if the plan fails in an emergency, or when there are changes to the facility, the list of emergency coordinators, or the list of emergency equipment. A copy of the contingency plan (and any revisions) must be maintained at the facility and provided to all local authorities who may have to respond to emergencies.

■ Emergency Coordinator

The TSDF owner and operator must designate an emergency coordinator to guide emergency response activities. The emergency coordinator is responsible for assessing emergency situations and making decisions on how to respond. There must be at least one employee either on the facility premises or on call with the authority to commit the resources needed to carry out the contingency plan.

■ Emergency Procedures

During an emergency, measures must be taken to ensure that fires, explosions, and releases do not occur, recur, or spread. In the event of an imminent or actual emergency situation, the emergency coordinator must immediately activate internal facility alarms or communication systems and notify appropriate state and local authorities. If the coordinator determines that the emergency threatens human health or the environment outside of the facility and finds that evacuation of local areas may be advisable, the coordinator must notify appropriate authorities, and either the designated government official for the area or the National Response Center.

MANIFEST, RECORDKEEPING, AND REPORTING

To keep track of hazardous waste activities, TSDF owners and operators must keep records and make reports to EPA. The manifest system tracks each off-site shipment of hazardous waste. The operating record and biennial report detail facility and waste management over time.

■ Manifest

When a waste shipment is received from off site, the TSDF owner and operator must sign and date all copies of the manifest to verify that the waste has reached the appropriate designated facility. The TSDF must keep a copy for its records and send a copy to the generator within 30 days to verify that the waste has been accepted. If the off-site shipment originated in a foreign country, the TSDF owner and operator must send a copy of the signed and dated manifest to EPA in Washington, D.C. within 30 days of shipment delivery. If the owner and operator of a TSDF must send the waste to an additional TSDF for further treatment or disposal, they must initiate a new manifest.

A new manifest must also be used for rejected shipments or container residues that are forwarded to an additional TSDF or are returned to the actual generator. If, however, the TSDF rejects the entire waste shipment before the delivering transporter leaves the TSDF's facility, then the TSDF may use the original manifest.

■ Operating Record

To keep track of hazardous waste activity at the facility, the owner and operator is required to keep, until the facility closes, a written operating record on site describing all waste received; methods and dates of treatment, storage, and disposal; and the wastes' location within the facility. All information should be cross-referenced with the manifest number. Other information that the TSDF must keep in its operating record includes:

- Waste analysis results
- Details of emergencies requiring contingency

plan implementation

- Inspection results (required to be kept for three years).

While most records may be kept in computer files, the TSDF owner and operator must keep original, signed copies of all manifests for inspection purposes. All records and plans must be available for inspection.

■ Biennial Report

To track hazardous waste activity nationwide, RCRA requires TSDFs to report to EPA the types and amounts of hazardous wastes generated, received, treated, stored, and disposed. TSDFs that generate hazardous waste through the course of on-site treatment, storage, or disposal must also describe waste minimization efforts taken to reduce the volume and toxicity of wastes generated, as well as describe the changes in volume or toxicity actually achieved, compared with those achieved in previous years. Reports are due to the EPA Regional Administrator on March 1 of each even-numbered year, and must detail the waste managed during the previous (odd-numbered) year. For example, the biennial report covering 2009 activities would be due March 1, 2010. Additionally, some states may require submission of such reports annually. Each owner and operator should consult their state agency for more specific biennial reporting information.

■ Import Notification

If a TSDF, or interim status TSDF, expects to receive hazardous waste from a foreign source, the TSDF owner or operator must notify the EPA Regional Administrator in writing at least four weeks prior to the date they would receive the first shipment. Subsequent shipments of the same waste from the same source would not require this notification.

■ Additional Reports

Other reports that must be supplied to the implementing agency include, but are not limited to, reports of releases, fires and explosions, ground water contamination and monitoring data, and facility closure information. Spills may also trigger reporting requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Clean Water Act (CWA). (CERCLA and EPCRA are fully discussed in Chapter VI.)

STANDARDS FOR HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL UNITS

Hazardous waste managed at TSDFs may be treated, stored, or disposed of in several different types of units. In order to ensure that hazardous wastes are managed properly and in a safe manner, RCRA imposes design, construction, operation, maintenance, closure, and financial assurance requirements on hazardous waste management units.

Some of these units treat, store, or dispose of hazardous waste in or on the ground. Because these land-based units (i.e., land treatment units, landfills, surface impoundments, and waste piles) manage waste directly on the land, they have the potential to generate hazardous leachate that can pose a serious threat to soil, surface water, ground water, and human health and the environment.

To minimize the potential for leachate to threaten human health and the environment, EPA developed design and operating standards that use a combination of different technologies and good operating practices to detect, contain, and clean up any leaks that might occur.

Waste management has the potential to threaten air as well. In order to minimize the risks that hazardous waste management poses to air, RCRA includes standards to control air emissions from certain hazardous waste management operations and units.

■ Containers

Containers are one of the most commonly used and diverse forms of hazardous waste storage units. A container is any portable device in which a material is stored, transported, treated, or otherwise

handled. Examples of hazardous waste containers include, but are not limited to: 55-gallon drums, large tanker trucks, railroad cars, small buckets, and test tubes. When EPA promulgated the unit-specific requirements for hazardous waste containers, the Agency emphasized that although mismanagement of containers has caused severe contamination in the past, relatively few regulations would be needed to ensure proper management. As a result, the container standards consist of very streamlined and basic management requirements.

Design Standards

Containers must be in good condition. Containers that are deteriorating (e.g., cracked, rusted, or leaking) cannot be used. Waste stored in defective containers must be transferred to containers in good condition or managed in another type of unit.

Operating Requirements

Containers holding hazardous waste must be kept closed, except when adding or removing waste, to prevent their contents from spilling. In addition, containers must not be handled, opened, or stored in a way that might cause them to leak.

Inspections

In order to ensure that containers are being managed in compliance with these regulations, owners and operators must visually inspect container storage areas periodically for leaking and deteriorating containers.

Release Prevention and Response

To further prevent releases of hazardous waste into the environment, containers holding liquid hazardous wastes at a permitted TSDF must have a secondary containment system. Secondary containment is emergency short-term storage designed to hold leaks from hazardous waste management units. An example of a secondary containment system for containers is a sloped concrete pad that drains leaked waste into a tank. The secondary containment system must be free of cracks, able to contain the spill, and emptied quickly. Containers at interim status facilities do not have secondary containment requirements.

Special Wastes

When handled improperly, some wastes can ignite or explode. To protect communities near the facility from these dangers, containers holding ignitable or reactive wastes must be located at least 50 feet from the facility's property line.

Other Requirements

In addition to the provisions above, containers storing or treating certain hazardous wastes are subject to RCRA air emission control requirements (as discussed later in this chapter). LQGs and SQGs accumulating waste in containers are subject to the interim status TSDF standards for these units. SQGs, however, are not subject to the air emission control requirements. (Generator requirements are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

■ Containment Buildings

A **containment building** is a completely enclosed self-supporting structure (i.e., with four walls, a roof, and a floor) used to store or treat noncontainerized waste. Containment buildings are generally used for the management of hazardous waste debris and other bulky and high volume hazardous wastes, but may be employed for the management of any nonliquid hazardous waste.

Design Standards

The design standards for containment buildings stress structural soundness and hazardous waste leak prevention. To ensure that a containment building meets these standards, a professional engineer must certify that the unit is designed and installed according to the following specifications:

- The containment building must be completely enclosed with four walls, a floor, and a roof.
- The walls, floor, and roof must be constructed of man-made materials with enough strength to withstand movement of wastes, personnel, and heavy equipment within the building.
- Dust control devices, such as air-lock doors or negative air pressure systems (that pull air into the containment building) must also be used as

necessary to prevent hazardous waste dust from escaping through these building exits.

- All surfaces in the containment building that come into contact with wastes during treatment or storage must be chemically compatible with such wastes. Incompatible wastes that might cause unit failure cannot be placed in containment buildings.

If the containment building is used to manage hazardous waste with visible liquids, or if waste treatment being conducted in the building requires the addition of liquids to the waste, the owner and operator must equip the unit with the following:

- A primary barrier constructed of materials to prevent migration of the waste into the barrier
- A liquid collection system to minimize standing liquids in the containment building and to facilitate liquid removal
- A leak detection system located immediately beneath the floor to indicate any weakness in the floor and leaks of hazardous waste from the unit
- A secondary barrier, such as a liner, constructed around the unit to contain any leaks and to facilitate cleanup before they reach nearby soils, surface water, or ground water. As with the unit floor, the secondary barrier must be structurally sound and chemically resistant to wastes and liquids managed in the containment building.

Some containment buildings designate certain areas (known as wet areas) for the management of liquid-containing wastes. Such buildings only need secondary containment for these wet areas, provided that waste liquids cannot migrate to the dry areas of the containment building.

Operating Requirements

Containment building operating requirements focus primarily on maintenance and inspection of the unit, recordkeeping requirements, and provisions for response to releases of hazardous waste. Among other requirements, owners and operators must:

- Maintain the floor so that it is free of significant cracks, corrosion, or deterioration
- Repair or replace surface coatings or liners that are subject to wear from movement of waste, personnel, or equipment as often as needed
- Limit the height of wastes piled within the unit
- Maintain dust control devices at all openings to prevent emissions from the unit
- Provide a decontamination area within the containment building (e.g., an area for washing vehicles and equipment prior to leaving the building) to prevent the tracking of waste out of the unit.

Inspections

Containment buildings must be inspected at least once every seven days, with all activities and results recorded in the operating log. During inspection, the owner and operator should evaluate the unit's integrity and assess nearby soils and surface waters to detect any signs of waste release. For purposes of these inspections, the owner and operator should also consider information from monitoring or leak detection equipment.

Release Prevention and Response

If a release is discovered during an inspection or at any time, the owner and operator must take the leaking portion of the unit out of service and take all appropriate steps to repair the leak and contain the released waste. The owner and operator must also notify the EPA Regional Administrator of the release and of the proposed schedule for repair of the unit. Upon completion of all necessary repairs and cleanup, a qualified, registered, professional engineer must verify, to the EPA Regional Administrator, that the facility complied with the plan.

Other Requirements

LQGs accumulating waste in containment buildings are subject to the interim status TSDF standards for these units. (Generator requirements are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

■ Drip Pads

Drip pads are engineering structures consisting of a curbed, free-draining base, constructed of nonearthen materials, and designed to convey wood preservative chemical drippage from treated wood, precipitation, and surface water run-on to an associated collection system at wood preserving plants. In the wood preserving process, preservative solutions are commonly applied to wood products using a pressure treating process. Once the preservative solution has been applied to the wood, it is removed from the process unit and excess solution is allowed to drip from the wood onto drip pads. The pads collect the drippage (along with rainwater and surface water that has entered the pad) and convey it to a tank, container, or other such unit until the waste may be recycled, treated, or disposed of.

Design Standards

The various elements of a drip pad must be designed and constructed to handle the wastes managed on the unit and prevent those wastes from leaking into the environment.

Pad

The owner and operator of the drip pad must construct the pad of nonearthen materials (e.g., concrete or metal) and ensure that the pad is strong enough to prevent collapse, cracking, or other failure. The surface of the pad must have a raised barrier (called a berm) around the perimeter to prevent waste from running off the pad. It must be sloped to help the drippage flow into the collection unit, and must either be treated with impermeable sealers, coatings, or covers to prevent liquid from seeping into the base, or have a liner with a leak detection and collection system.

Liquid Collection System

The liquid collection system must be designed to prevent overflow, allow facility personnel to easily remove waste from the unit, and comply with the hazardous waste tank standards. Where applicable, the liquid collection system must also be protected from rain water running into and out of the unit.

Liner and Leak Detection System

The liners and leak detection system for drip pads do not have specific technical design criteria, but must be structurally sound and chemically compatible with the preservative drippage, and must be able to signal releases from the drip pad at the earliest practicable time.

Operating Requirements

Generally, a drip pad must be free of cracks and show no signs of corrosion or other types of deterioration. Drip pads must be cleaned frequently to allow for inspections of the entire drip pad surface without interference from accumulated wastes and residues. In addition to occasional cleaning, drippage and precipitation from the liquid collection system must be emptied as often as necessary to prevent the waste from flowing over the curb around the unit. All collection tanks must also be emptied as soon as possible after storms to ensure that they do not overflow back onto the pad. Lastly, owners and operators must minimize the tracking of hazardous waste by personnel and vehicles.

Inspections

Drip pads must be inspected weekly and after storms to ensure that the pad and the liquid collection systems are functioning properly and to check for deterioration of or leaks from the units. If, upon inspection, a drip pad shows any deterioration, the owner and operator must take the affected portion of the unit out of service for repairs before returning it to service.

Other Requirements

LQGs accumulating waste on drip pads are subject to the interim status TSDF standards for these units. (Generator requirements are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators).

■ Land Treatment Units

Land treatment units, or land farms, are seldom-used land disposal units. Land treatment involves the application of waste on the soil surface, or the incorporation of waste into the upper

layers of the soil in order to degrade, transform, or immobilize hazardous constituents present in hazardous waste. The waste is placed in the portion of the surface soil above the water table (or the highest point of the ground water flow) to let the soil microbes and sunlight degrade the hazardous waste. The design and operating requirements for land treatment units are quite different from other waste management units because they utilize biodegradation as a method of hazardous waste treatment, thus necessitating certain operating and waste management conditions.

Design Standards

Land treatment units must be equipped with run-on, run-off, and wind dispersion controls. Run-on and run-off controls prevent rain water and other liquids from running onto the unit (and creating leachate) and stop this leachate from running off the unit, thus carrying contaminants into surrounding soils, surface waters, and ground water. Wind dispersal controls prevent wind gusts from blowing small particles of hazardous waste off a land treatment unit into the air and surrounding soils and surface water. To prevent wind dispersal, owners and operators of land treatment units must apply a wind dispersal control, such as a cover, to the unit.

Operating Requirements

The operating requirements for land treatment units are intended to promote and maintain the biodegradation of hazardous wastes placed in the unit. Maintenance of proper soil pH, careful management of waste application rate, and control of surface water run-off are all key to the operation of a land treatment unit. The operation requirements include:

- Controls on the rate and method of waste application
- Measures to control soil acidity
- Measures to enhance microbial and chemical reactions
- Measures to control the moisture content of the area where wastes are treated.

Treatment Program and Demonstration

In order to guarantee that these waste treatment practices will be conducted to properly degrade the waste, owners and operators of land treatment units must design a treatment program that takes into account the characteristics of the site and the wastes to be handled. The owner and operator must then demonstrate to EPA the effectiveness of this program. A treatment demonstration may involve field testing on a sample soil plot or laboratory testing. Interim status land treatment units are not required to establish a treatment program, but owners and operators can only place hazardous waste in the land treatment unit if the waste will be rendered nonhazardous or less hazardous.

Food Chain Crops

In some cases, an owner and operator may grow food-chain crops (crops grown for human consumption) in a land treatment unit. The Agency believes that this can be done safely if the owner and operator can demonstrate that hazardous constituents are not present in the crop in abnormally high levels. Additionally, if cadmium is present in the unit, the owner and operator must comply with additional management standards.

Inspections

The owner and operator must inspect the treatment area weekly and after storms to ensure that the unit is in compliance with the operating criteria. In addition, the owner and operator must establish a soil monitoring program. If there is significant evidence that the wastes in the unit are not responding to treatment and are sinking towards the water table, the owner and operator must notify the EPA Regional Administrator within seven days and modify the treatment program to ensure the sufficient treatment of hazardous constituents within the treatment zone.

Special Wastes

Certain types of hazardous wastes pose such a threat to human health and the environment that their management requires additional regulatory precautions. Considering the risks associated with the treatment, storage, and disposal of certain

dioxin-containing hazardous wastes (F020, F021, F022, F023, F026, and F027), the RCRA regulations restrict the management of these wastes in land treatment units. As a result, owners and operators can only manage these wastes in a permitted land treatment unit in accordance with a special management plan approved by the EPA Regional Administrator. These wastes may not be handled in interim status land treatment units because these units do not meet the strict construction standards and, thus, may not be sufficiently protective.

■ Landfills

A **landfill** is a disposal unit where nonliquid hazardous waste is placed in or on the land. Landfills are the final disposal site, the ultimate grave, for a significant portion of the hazardous waste that is generated in the United States.

Design Standards

To minimize the potential for leachate to leak from a landfill, EPA developed the following design standards:

- Double liner
- Double leachate collection and removal system
- Leak detection system
- Run-on, run-off, and wind dispersal controls
- Construction quality assurance.

Double Liner

The double liner system has two components: a top liner and a composite bottom liner. The top liner, usually a synthetic material, keeps the liquid waste in the unit and prevents migration of hazardous leachate and waste into the liner. The composite bottom liner, consisting of a synthetic liner (made of a special kind of plastic) on top of three feet of compacted soil material, is designed to prevent any liquids that have leaked through the top liner from reaching underlying soils and ground water.

Double Leachate Collection and Removal System

Landfills must also be equipped with two leachate collection and removal systems. The first rests on the top liner, and the second between the top liner and the bottom composite liner. The top system collects any leachate that has filtered down through the waste in the unit and pumps it out to a collection tank, where it may be collected and disposed. The bottom system collects any leachate that has leaked through the top liner and similarly pumps it out to a collection tank, where it may similarly be collected and disposed.

Leak Detection System

While the lower leachate collection and removal system will continually remove the small amounts of liquid that might seep through the top liner, it may not be capable of handling a larger leak. Larger leaks can apply strong pressure on the bottom liner, potentially causing it to fail. To avoid this problem, RCRA requires that a leak detection system be installed within the leachate collection and removal system. This system must be able to detect when the flow rate into the leachate collection and removal system is above a normal operating range, and warn the owner and operator that the top liner may be leaking.

Run-On, Run-Off, and Wind Dispersal Controls

The run-on, run-off, and wind dispersal requirements are identical to those for land treatment units.

Construction Quality Assurance

None of these technologies are effective if the landfill is installed improperly or constructed of inferior materials. To ensure that a landfill meets all the technological requirements, EPA requires a **construction quality assurance** program. The program mandates a construction quality assurance plan that identifies how construction materials and their installation will be monitored and tested and how the results will be documented. The program must be developed and implemented under the direction of a registered professional engineer, who must also certify that the construction quality

assurance plan has been successfully carried out and that the unit meets all specifications before any waste is placed into the unit.

Operating Requirements

In order to prevent the formation and migration of leachate in landfills, owners and operators may not place liquid hazardous wastes in a landfill, unless the wastes are in:

- Very small containers, such as ampules
- Containers, such as batteries, that contain small amounts of liquid for purposes other than storage
- **Lab packs** which consist of drums filled with many small containers packed in nonbiodegradable absorbent materials.

Owners and operators may add nonbiodegradable absorbents to containers of liquid hazardous waste to remove any visible liquids. After all visible liquids have been removed, the owner and operator may then place the waste in a landfill.

Inspections

To ensure that the liners and leachate collection and removal systems are working properly, landfill owners and operators must:

- Inspect liners for any problems after construction or installation and continue inspections weekly and after storms to monitor for evidence of deterioration or damage
- Monitor leachate collection and removal system sumps at least weekly to measure the amount of liquid in the sumps and determine whether the upper liner might be leaking. This is designed to verify both the integrity of the liner and the efficiency of the leachate pump. If the level indicates a substantial leak, the owner and operator must notify EPA and respond in accordance with the facility's response action plan.

Release Prevention and Response

In order to prepare for a leak from a landfill, RCRA requires that owners and operators of hazardous waste landfills develop a response action plan. The response action plan outlines the short- and long-term actions to be taken in the event of a leak. A short-term action might involve shutting off the flow of hazardous waste into the landfill. A long-term action might involve emptying the unit and repairing or replacing the damaged liner or leachate collection and removal systems. As part of the plan, in the event of a leak, the owner and operator must notify the EPA Regional Administrator, determine what short-term actions must be taken, determine the location, size, and cause of any leak, and report the findings to the EPA regional office.

Special Wastes

Similar to land treatment units, permitted landfills can only treat, store, or dispose of certain dioxin-containing hazardous wastes (F020, F021, F022, F023, F026, and F027) if the unit has a special management plan approved by the EPA Regional Administrator. These wastes cannot be managed in interim status landfills.

Special Requirements for Certain Containers in Landfills

Over time, the hazardous waste containers placed in a landfill will decompose and collapse, creating air pockets under the landfill cover. When the wastes surrounding the container settle to fill the void, the liner may also settle. Such settling may cause the liner to stretch or tear. To prevent significant voids that could cause collapse of final covers and tearing of liners when containers erode and to maintain and extend available capacity in hazardous waste landfills, containers placed in a landfill must either be:

- At least 90 percent full

OR

- Crushed, shredded, or in some other way reduced in volume (unless they are very small containers, such as ampules).

■ Surface Impoundments

A **surface impoundment** is a natural topographic depression, man-made excavation, or

diked area formed primarily of earthen materials (although it must be lined with man-made materials) that is used to treat, store, or dispose of liquid hazardous waste. Examples include holding ponds, storage pits, and settling lagoons.

Design Standards

To minimize the potential for leachate to leak from a surface impoundment, EPA developed the following design standards:

- Double liner
- Leachate collection and removal system
- Leak detection system
- Dikes, berms, and freeboard
- Construction quality assurance.

Double Liner

The double liner system requirements are identical to those for hazardous waste landfills.

Leachate Collection and Removal System

The unit must be equipped with a leachate collection and removal system between the top liner and the bottom composite liner. The system collects any leachate that has leaked through the top liner and pumps it out to a collection tank. The system features a pump system and drainage layers to slow the flow of the leak. The system must be designed with a minimum bottom slope to help drainage, be made of materials that will not chemically react with the wastes placed in the unit, and be able to remove the liquids at a specified minimum rate.

Leak Detection System

The leak detection system requirements are identical to those for hazardous waste landfills.

Dikes, Berms, and Freeboard

A surface impoundment must also be designed to prevent the flow of liquids over the top of an impoundment (overtopping). This is accomplished by constructing and maintaining dikes or berms (walls or man-made hills surrounding the unit) and ensuring a minimum distance (called freeboard) between the surface of the waste and the top of the impoundment to prevent overflow during high winds or rainstorms.

Construction Quality Assurance

The construction quality assurance program requirements are identical to those for hazardous waste landfills.

Inspections

To ensure that the liners and leachate collection and removal system are working properly, owners and operators of hazardous waste surface impoundments must:

- Inspect liners and dikes or berms for any problems after construction or installation, and continue inspections weekly and after storms to monitor for evidence of deterioration, sudden drops in the level of the impoundment contents, and severe erosions of dikes and other containment devices
- Monitor leachate collection and removal system sumps at least weekly to measure the amount of liquid in the sump and determine whether the upper liner might be leaking. This is designed to verify both the integrity of the liner and the efficiency of the leachate pump. If the level indicates a substantial leak, the owner and operator must notify EPA and respond in accordance with the facility's response action plan.

Release Prevention and Response

The release prevention and response requirements are identical to those for hazardous waste landfills.

Special Wastes

Similar to land treatment units and landfills, permitted surface impoundments can only treat, store, or dispose of certain dioxin-containing hazardous wastes (F020, F021, F022, F023, F026, and F027) if the unit has a special management plan approved by the EPA Regional Administrator. These wastes cannot be managed in interim status surface impoundments.

Other Requirements

Other surface impoundment requirements include retrofitting provisions and air emissions requirements.

Surface Impoundment Retrofitting

Surface impoundments handling nonhazardous wastes are not subject to these extensive hazardous waste surface impoundment design and operating requirements. However, such impoundments may become subject to RCRA if the waste being handled in the unit becomes a hazardous waste as a result of a new hazardous waste listing or characteristic. In these cases, the owner and operator of the impoundment must retrofit the unit to meet the standards described above, or cease receipt of the hazardous waste and begin the closure process. Owners and operators have four years from the day that the listing or characteristic is finalized (in the *Federal Register*) to retrofit or close. For example, owners and operators of surface impoundments that became subject to RCRA as the result of the promulgation of the toxicity characteristic waste codes on March 29, 1990, were required to retrofit those units to meet the design and operating standards, or cease receipt of hazardous waste and begin closure by March 29, 1994.

These retrofitting requirements may be waived by the implementing agency under special circumstances. The impoundment must be designed, operated, and located in such a manner that there will be no migration of hazardous constituents into ground water or surface water at any time. Furthermore, the impoundment may contain only characteristic TC wastes. The implementing agency will determine on a site-specific basis whether a waiver from the retrofitting requirement is protective of human health and the environment.

Air Emissions

In addition to these requirements, surface impoundments storing, treating, or disposing of certain hazardous wastes are subject to RCRA air emission control requirements (as discussed later in this chapter).

■ Tanks

Tanks are stationary devices (as opposed to portable containers) used to store or treat hazardous waste. They are widely used for storage or accumulation of hazardous waste because they can accommodate huge volumes of material, sometimes in the tens of thousands of gallons. Tanks are used for the treatment of hazardous waste because of their structural strength and versatility. In order to ensure that a tank system can hold hazardous waste for its intended lifetime, a TSDF owner and operator must ensure that the tank is properly designed. RCRA requires that the tank system or components be designed with an adequate foundation, structural support, and protection from corrosion to prevent it from collapsing or leaking. In order to ensure that a tank is properly designed, an independent, qualified, registered, professional engineer must certify that the unit meets these requirements.

Design Standards

Hazardous waste tanks must be installed properly and designed to protect against corrosion.

Installation

Because even the most flawlessly designed tanks can fail if installed improperly, new tank systems must be inspected by an independent qualified expert prior to use to ensure that the tank was not damaged during installation. The owner and operator must repair any damage before the installation is complete or the system is in use. All new tanks and ancillary equipment must be tested to make sure that there are no leaks, and any leaks discovered must be fixed before the tanks are covered, enclosed, or placed in use.

Corrosion Protection

When metal tanks are in contact with soil or water, they can corrode and leak. To prevent leaks from corroded tanks, RCRA requires tanks made wholly or partly of metal to be designed and installed with adequate corrosion protection. To ensure that a tank is properly protected, an owner and operator must develop a written design plan. The design should take into account information specific to the site, such as soil moisture and acidity,

that can affect the corrosion rate of the tank. The unit must have one or more of the following corrosion protection methods:

- Construction materials that are corrosion-resistant (e.g., fiberglass)
- Corrosion-resistant coating in combination with cathodic protection (cathodic protection prevents tanks from corroding by reversing the naturally occurring electric current in the ground that can degrade tank walls)
- Electrical isolation devices.

Existing tanks do not have to meet these requirements because of the high cost of installing corrosion protection on tanks that are already in the ground. However, owners and operators of existing tanks must assess the structural integrity of the units to ensure that they are designed and maintained to contain the wastes stored or treated within them without failing, collapsing, or rupturing. Such assessments must be certified by an independent, qualified, registered, professional engineer.

Operating Requirements

Hazardous waste tanks must be operated in a manner that minimizes or eliminates releases. Chemicals that may cause any part of the tank's system to fail may not be placed in the unit.

Because the loading or filling of tanks brings the potential for spills or releases of waste into the environment, such spills or overflows from the tank system must also be prevented by using, at a minimum:

- Spill prevention controls, such as valves designed to prevent the backflow of waste while a tank is being filled
- Overfill prevention controls, such as alarms that sound when the waste level in the tank gets too high, and valve systems that automatically close when overfill is likely
- Sufficient room within an uncovered tank between the surface of the waste and the top of the tank (minimum freeboard).

Inspections

To verify that hazardous waste tanks and components are operated and maintained in satisfactory condition, owners and operators must inspect their tanks daily. To meet these objectives, inspections must thoroughly identify leaks, deterioration, corrosion, or structural fatigue in any portion of the tank or system components. In addition to visual inspections, owners and operators must also take into account any data received from leak detection monitors and other tests.

Release Prevention and Response

The release response requirements require leak detection systems to detect leaks, and secondary containment devices to contain any leaks that might occur from the tank or ancillary equipment. All new hazardous waste tank systems must have leak detection and secondary containment before being placed in service. Existing systems must be equipped with secondary containment by different deadlines, based on a phased-in schedule determined by the age of the tank.

Leak Detection

Hazardous waste tanks must be equipped with a leak detection system. The leak detection system must be able to detect failure in either the main tank or secondary containment system generally within 24 hours. Thermal conductivity sensors, electrical resistivity sensors, and vapor detectors are commonly used leak detection devices. Daily visual inspections may also be used where tanks and tank components are physically accessible.

Secondary Containment

To make sure the tank system will perform properly, secondary containment systems must be designed, installed, and operated to ensure that:

- No waste is released to the surrounding soil, ground water, or surface water
- Construction materials or liners are compatible with the waste to be stored or treated in the tank
- The tank is capable of containing accumulated material until it is promptly removed (generally

within 24 hours)

- The tank has sufficient structural strength to prevent failure
- The foundation can resist failure due to normal movement of the surrounding soils (settlement, compression, or uplift).

Owners and operators must meet these requirements by using one of the following secondary containment devices:

- An external liner that completely surrounds the unit with an impermeable material
- A vault (the tank rests in an underground chamber usually constructed with concrete floors and walls and an impermeable cover)
- A double-walled tank (the tank is completely enclosed inside another tank with a leak detection monitoring system installed between the two)
- An EPA-approved alternative design.

In addition to the tank itself, all ancillary equipment (e.g., pipes, valves, trenches connected to the tank or tank system) must have full secondary containment. Examples of secondary containment for ancillary equipment include lined trenches, and jacketed or double-walled piping. When inspected daily, however, the following equipment is exempt from this requirement:

- Above ground piping (not including flanges, joints, valves, and connections)
- Welded flanges, welded joints, and welded connections
- Seal-less or magnetic coupling pumps
- Aboveground pressurized piping systems with automatic shut-off devices.

Despite these precautions, occasionally a tank system or secondary containment system will leak or spill hazardous waste. When this happens, the owner and operator must immediately take the tank out of operation and determine the cause of the release. To prevent the spill from moving further away from the tank, the owner and operator must also remove and properly dispose of any contaminated soil, ground water, or surface water. In addition, the owner and operator must notify the EPA Regional Administrator or National Response Center, and submit a follow-up written report to the EPA Regional Administrator within 30 days. The tank must then either be repaired or closed.

Other Requirements

In addition to these requirements, tanks storing or treating certain hazardous wastes are also subject to RCRA air emission control requirements (as discussed later in this chapter). LQGs and SQGs accumulating waste on site in tanks are subject to the interim status TSDF standards for these units. (Generator requirements are fully discussed in Chapter III, Regulations Governing Hazardous Waste Generators). SQGs, however, are not subject to the air emission control requirements.

■ Waste Piles

A **waste pile** is an open pile used for treating or storing nonliquid hazardous waste. The standards for these units are very similar to those for landfills, but the difference is that waste piles may be used for temporary storage and treatment only, not disposal.

Design Standards

To minimize the potential for leachate to leak from a waste pile, EPA developed the following design standards:

- Double liner
- Double leachate collection and removal system
- Leak detection system
- Run-on, run-off, and wind dispersal controls
- Construction quality assurance.

Double Liner

The double liner system requirements are identical to those for hazardous waste landfills and surface impoundments.

Double Leachate Collection and Removal System

The double leachate collection and removal system requirements are identical to those for hazardous waste landfills.

Leak Detection System

The leak detection system requirements are identical to those for hazardous waste landfills and surface impoundments.

Run-On, Run-Off, and Wind Dispersal Controls

The run-on, run-off, and wind dispersal control requirements for permitted waste piles are identical to those for hazardous waste landfills. However, interim status waste piles are not subject to the storm water controls, but are subject to wind dispersal controls.

Construction Quality Assurance

The construction quality assurance program requirements are identical to those for hazardous waste landfills and surface impoundments.

Operating Requirements

Under no circumstances can an owner and operator place liquid hazardous waste in a waste pile.

Inspections

The liner and leachate collection and removal system inspection requirements are identical to those for hazardous waste landfills.

Release Prevention and Response

The release prevention and response requirements are identical to those for hazardous waste landfills.

Special Wastes

Similar to land treatment units, landfills, and surface impoundments, permitted waste piles can only treat, store, or dispose of certain dioxin-containing hazardous wastes (F020, F021, F022, F023, F026, and F027) if the unit has a special management plan approved by the EPA Regional Administrator. These wastes cannot be managed in interim status waste piles.

Other Requirements

Owners and operators of permitted waste piles that are located indoors and meet special requirements are subject to reduced regulation. Specifically, the waste pile must:

- Be located inside or under a structure
- Not receive liquid wastes
- Be protected from surface water run-on
- Be designed and operated to control dispersal of waste
- Be managed to prevent the generation of leachate.

If these standards are met, the owner and operator of the permitted waste pile is exempt from ground water monitoring requirements as well as the design and operation requirements for waste piles. RCRA provides this exemption because when properly designed and maintained, indoor waste piles can prevent hazardous leachate from forming or leaking into the environment.

■ Miscellaneous Units

When RCRA was enacted in 1976, there was a diverse universe of hazardous waste management units in existence. Some of these units did not fit the definition of any of the typical hazardous waste management practices described earlier in this chapter. These include physical, chemical, and biological treatment units; thermal treatment units; and underground injection control (UIC) wells. As a result, EPA established interim status standards for these units. When EPA established final permitted TSDF standards for all hazardous waste management units, the Agency did not establish final standards for physical, chemical, and biological treatment units or thermal treatment units, but rather grouped them together and permitted them as miscellaneous units. EPA did not include UIC wells in this miscellaneous unit category because such wells were later addressed under SDWA.

At present, all new hazardous waste management units that do not fit the definition of one of the types of units discussed earlier in this chapter or an incinerator or boiler and industrial furnace (BIF) (as discussed in Chapter III, Hazardous Waste Combustion) are permitted as miscellaneous units. This section of the chapter will present the management standards for such units. For historical purposes, this section of the chapter will also present the interim status standards for physical, chemical, and biological treatment units; thermal treatment units; and UIC wells.

Because the standards for miscellaneous units address treatment, storage, and disposal processes that are not addressed by other unit-specific standards, the following management standards consist of general operating requirements that may be modified and amended based on site-specific considerations.

Permitted Miscellaneous Units

Since some TSDFs treat, store, or dispose of waste in units that are different from the previously described hazardous waste management units, RCRA established broad and protective management provisions for miscellaneous units to allow for the use of new and innovative waste management technologies. The RCRA standards are designed to give the implementing agency the flexibility to tailor permit standards, on a case-by-case basis, to these unique waste management practices.

Miscellaneous units are defined as treatment, storage, or disposal units other than:

- Containers, containment buildings, drip pads, land treatment units, landfills, surface impoundments, tanks, or waste piles (as discussed earlier in this chapter)
- Incinerators or BIFs (as discussed in Chapter III, Hazardous Waste Combustion)
- Corrective action management units (CAMUs) (as discussed in Chapter III, Corrective Action to Cleanup Hazardous Waste Contamination)
- Units permitted for research, development, and demonstration (RD&D) (as discussed in Chapter III, Permitting of Treatment, Storage, and Disposal Facilities)
- UIC wells.

Miscellaneous units may include, but are not limited to:

- Geologic repositories (e.g., underground caves)
- Deactivated missile silos
- Thermal treatment units
- Units for the open burning or detonation of waste explosives
- Chemical, physical, or biological treatment units.

Since miscellaneous units are subject to site-specific design and operating requirements, RCRA requires that owners and operators applying for a permit provide the implementing agency with detailed information on unit design and potential environmental impacts. The owner and operator must provide detailed plans and engineering reports describing the unit location, design, construction, operation, maintenance, monitoring plans, and inspection plans.

Owners and operators must also provide detailed information on the potential pathways of human or environmental exposure to hazardous waste or hazardous constituents. Under these provisions, owners and operators must evaluate the potential magnitude and nature of potential human and environmental exposure to air, surface water (including wetlands), ground water, and soil. Owner and operators of miscellaneous units are required to conduct monitoring, testing, data analysis, inspections, and response actions (if necessary) in order to ensure that the unit is in compliance with its general performance standards, and that waste management has not threatened any of these environmental mediums.

Interim Status Chemical, Physical, and Biological Treatment Units

When RCRA was first enacted in 1976, some of the diverse hazardous waste management units in existence were chemical, physical, and biological treatment units. Such units employed

unique treatment processes, such as distillation, centrifugation, reverse osmosis, ion exchange, and filtration. The Agency established interim status standards for such units to address the safe containment of hazardous waste, hazardous waste constituents, and treatment by-products.

The operating standards for these units require that:

- Waste is compatible with treatment equipment
- Ignitable and reactive wastes are decharacterized immediately before or after placement in the treatment process or equipment
- Waste analysis and trial treatment tests verify that treatment will meet applicable requirements
- Owners and operators inspect discharge control, safety, and monitoring equipment daily; and inspect construction materials of treatment processes and confinement structures weekly.

Interim Status Thermal Treatment Units

After the enactment of RCRA, another set of diverse hazardous waste management units in existence were thermal treatment units. EPA established interim status standards for these units to allow for the development of alternative treatment processes in units that did not meet the definition of an incinerator or BIF (as discussed in Chapter III, Hazardous Waste Combustion).

Thermal treatment is defined as the treatment of hazardous waste in a device that uses elevated temperatures as the primary means to change the chemical, physical, or biological character or composition of the hazardous waste. Thermal treatment units include carbon regeneration units and other devices employing processes, such as molten salt pyrolysis, calcination, wet-air oxidation, and microwave destruction.

The operating standards for these units require:

- The establishment of steady, normal conditions of operation or readiness
- Waste analysis to determine the heating value of the waste, and concentrations of halogens, sulfur, lead, and mercury
- Monitoring and inspections of temperature and emission-control instruments, the stack plume, and all process and ancillary equipment.

The implementing agency also has the flexibility to develop standards for these units on a case-by-case basis when considering the technology-specific data submitted by the applicant. It is probable that the regulations for specific thermal treatment units will reference the incinerator, boiler, and industrial furnace standards due to the similarities between the units.

Interim Status Underground Injection Control Wells

Underground injection control wells are units into which hazardous waste is permanently disposed of by injection 1/4 mile below an aquifer with an underground source of drinking water (as defined under SDWA). EPA originally intended to regulate UIC wells disposing of hazardous waste under SDWA. At the inception of the RCRA program, however, many states did not yet have a SDWA-approved UIC program. As a result, EPA imposed RCRA requirements on such units until states gained SDWA approval for their UIC programs. Because UIC wells were not addressed by the unit-specific hazardous waste management standards, RCRA initially regulated such UIC wells as interim status units. These standards required UIC wells to comply with interim status general facility standards, with the exception of closure and financial assurance.

After states gained SDWA approval for their UIC programs, such wells became regulated jointly by SDWA and RCRA. SDWA regulates the design, operating, and closure standards for the well itself, while RCRA regulates any other hazardous waste-related activities at that facility up until the point of injection. While such wells are no longer subject to RCRA interim status standards, they would need a RCRA permit-by-rule, requiring compliance with only certain RCRA administrative requirements.

As an alternative to receiving a SDWA UIC well permit (accompanied by a RCRA permit-by-rule), UIC well owners and operators could also choose to apply for a full RCRA permit as a miscellaneous unit.

CLOSURE

All hazardous waste TSDFs will eventually stop receiving waste for treatment, storage, or disposal. After these facilities are closed, the owner and operator must either remove all waste that has accumulated in units at the facility, or leave the waste in place while maintaining the units in a way that ensures they will not pose a future threat to human health and the environment. RCRA Subtitle C's closure and post-closure standards are designed to achieve this goal.

The closure and post-closure regulations are divided into two parts: the general standards applicable to all TSDFs, and the technical standards for specific types of hazardous waste management units. These combined requirements ensure that a specific unit or facility will not pose a future threat to human health or the environment after a TSDF closes. This discussion will focus on the general closure standards applicable to all TSDFs.

■ Closure Requirements

Closure is the period directly after a TSDF stops its normal operations. During this period, a TSDF stops accepting hazardous waste; completes treatment, storage, and disposal of any wastes left on site; and disposes or decontaminates equipment, structures, and soils. Some owners and operators will completely remove all waste that was treated, stored, or disposed in their unit. This operation is known as **clean closure**. In order to demonstrate clean closure, an owner and operator must show that levels of hazardous contaminants at the facility do not exceed EPA-recommended exposure levels.

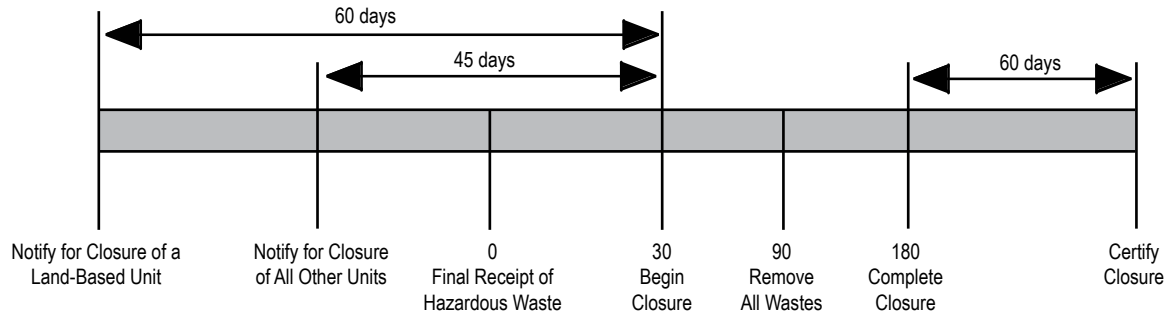
Closure Plan

To ensure that a TSDF is closed properly, the owner and operator must prepare a closure plan that details exactly how and when facility closure will take place, and must submit the plan to their implementing agency for approval. Permitted facilities are required to submit a closure plan to their implementing agency at the time of permit application. The approved closure plan then becomes an enforceable component of their permit. Interim status facilities must have a written closure plan on the premises six months after they become subject to RCRA. The closure plan must contain:

- A description of how the owner and operator will close each hazardous waste management unit
- A description of how and when the owner and operator will achieve final closure of the whole facility
- An estimate of the maximum amount of hazardous waste kept on site over the life of the facility
- A detailed description of closure methods, including the actions necessary to remove and manage waste and decontaminate the site
- A description of any other steps necessary to comply with the closure standards, such as ground water monitoring or leachate collection (depending on the type of unit).

When there is a change in the design or operation of the facility, a change in the expected closure date, or an unexpected event (e.g.,

Figure III-8: Timetable of Closure Activities



discovering more contaminated soil than originally anticipated), the owner and operator or the implementing agency must amend the closure plan to address the additional steps necessary to safely close the facility. In such instances, permitted facilities must submit an application to modify their permit, while interim status facilities must submit the proposed modification to the implementing agency for approval.

Closure Timetable

To ensure that facility closure is begun and completed in a timely manner, the closure regulations establish specific timetables for the initiation and completion of closure activities (see Figure III-8). An owner and operator of a closing TSDF must:

- Notify the implementing agency that they expect to begin closure activities (notification must take place at least 60 days before for surface impoundments, landfills, waste piles, and land treatment units, and at least 45 days before for all other units)
- Begin closure activities within 30 days of receiving the final shipment of hazardous waste
- Remove all hazardous wastes from the TSDF or dispose of the wastes on site within 90 days of beginning closure
- Complete all closure activities within 180 days of beginning closure
- Certify that closure has been completed in accordance with the specifications in the approved closure plan within 60 days of completing closure. The certification must be signed by the owner and operator and by an independent, registered, professional engineer.

The implementing agency may grant extensions, if required closure activities will take more time, or if the facility or unit has the capacity to accept more hazardous or nonhazardous waste.

During closure, all contaminated equipment, structures, and soils must be properly disposed or decontaminated. During this process, an owner and operator may become a generator of hazardous waste and must, therefore, comply with the generator requirements.

Delay of Closure

The closure timetable is designed to guarantee that closure is completed as soon as practicable after the final receipt of hazardous waste in order to minimize risks posed to human health and the environment. On the other hand, owners and operators of landfills, surface impoundments, and land treatment units may have room to accept nonhazardous waste at the time of closure. To enable these TSDFs to continue operation, RCRA allows these facilities to delay closure of such units. This delay is not available to any other units. Those units for which owners and operators choose to delay closure are still subject to all applicable RCRA hazardous waste requirements and must meet special requirements designed to ensure that the disposal of both the nonhazardous and hazardous waste will in no way endanger human health and the environment.

Survey Plat

After a TSDF ceases hazardous waste activity and closes all units, it still may be important to know exactly where hazardous wastes were handled (especially for purposes of future sale of the property). To preserve this information, the owner and operator must submit to the implementing agency or local zoning authority a survey plat indicating the location and dimensions of the closed hazardous waste units. The survey plat must be submitted no later than the submission of certification of closure for each hazardous waste disposal unit.

■ Post-Closure Requirements

Some TSDFs are intended for the final disposal of hazardous waste. Land treatment units, landfills, and surface impoundments are the only units where an owner and operator may permanently dispose of hazardous waste. Because such permanent land disposal brings the potential for releases from the unit over a long-term period, these owners and operators must conduct post-closure monitoring and maintenance activities. Other TSDFs may not be able to remove all hazardous wastes and decontaminate all equipment. Since these owners

and operators cannot clean close, they must close such units as landfills and comply with the post-closure requirements for landfills.

Post-closure is the period after closure during which owners and operators conduct monitoring and maintenance activities to preserve the integrity of the disposal system and continue to prevent or control releases from the disposal units. Post-closure care consists of two primary responsibilities: ground water monitoring and maintaining the waste containment system (e.g., covers, caps, and liners). Such activities include:

- Maintaining the final cover, the leak detection system, and the ground water monitoring systems
- Providing long-term protection from liquids migrating into the closed unit, promoting drainage of liquid, and accommodating settling of waste in the unit
- Making sure that the final cover, liners, or other containment or monitoring systems are not disturbed
- Monitoring ground water to detect any releases of hazardous constituents.

The post-closure period normally lasts for 30 years after closure is completed, but may be either extended or shortened by the EPA Regional Administrator.

Post-Closure Plan

In order to ensure that the post-closure care of the facility is properly carried out, the owner and operator must design and implement a post-closure plan. The owner and operator must submit the plan with the post-closure permit application. The plan must include:

- A description of planned ground water monitoring activities
- A description of planned maintenance activities
- The name, address, and telephone number of the facility contact person or office.

Post-Closure Notices

As with the survey plat for closure, owners and operators of TSDFs required to perform post-closure activities must, within 60 days after the facility originally certified closure, provide the local zoning or land use authority and the EPA Regional Administrator with a record of the type, location, and quantity of hazardous wastes in each disposal unit at the facility. Also, a notice must be placed in the property deed and recorded. This notice must state that the land was used for hazardous waste management, that the use of the land is restricted, and that the survey plat and record of closure were submitted to the local zoning authority and the EPA Regional Administrator.

Certification of Completion of Post-Closure Care

No later than 60 days after completion of the established post-closure care period for each hazardous waste disposal unit, the owner and operator must submit to the EPA Regional Administrator a certification that the post-closure care period was performed in accordance with the specifications established in the approved closure plan.

FINANCIAL ASSURANCE

The RCRA closure and post-closure requirements are designed to protect human health and the environment from the long-term threats associated with hazardous waste management and permanent disposal. Many of these detailed requirements apply at the end of a facility's waste management operations and can be very expensive. To prevent a facility from ceasing operations and failing to provide for the potentially costly closure and post-closure care requirements, EPA promulgated regulations requiring TSDFs to demonstrate that they have the financial resources to properly conduct closure and post-closure in a manner that protects human health and the environment.

The TSDF general facility standards include precautions to prepare a facility for accidents, spills, and any resulting emergency responses. Such unexpected events could damage third parties by

impacting human health or property outside the facility. In order to compensate third parties for injury or damage that might result from such events (known as **liabilities**), the RCRA regulations require TSDF owners and operators to demonstrate that they have the financial resources to pay for bodily injury or property damage that might result from waste management. The closure, post-closure, and liability financial resource requirements are called **financial assurance**.

In addition to requiring facilities to set aside funds for closure, post-closure, and liabilities, the RCRA regulations specify the financial mechanisms that TSDF owners and operators must use to ensure that the financial resources are available in the event that they are needed.

■ Financial Assurance for Closure/ Post-Closure Care

After a TSDF owner and operator prepares the required written closure and post-closure plans for their facility, they must prepare a cost estimate that reflects how much it would cost to hire a third-party contractor to close the facility. These estimates provide the base figure for the amount of financial assurance a facility must provide.

Cost Estimates

Cost estimates must reflect the cost of hiring a third party to conduct all activities outlined in the closure and post-closure plans. Closure cost estimates are based on the point in the facility's operating life when closure would be the most expensive. Post-closure cost estimates are based on projected costs for an entire post-closure period of 30 years, unless reduced or extended by the implementing agency.

Cost Adjustments

Closure and post-closure cost estimates must be adjusted annually for inflation until closure is completed. Owners and operators must also adjust cost estimates following any changes to their closure or post-closure plans that would raise the costs involved. For example, the addition of treatment units would mean that they will require decontamination at closure. The closure and post-closure estimates must be recalculated to reflect the additional expenses.

Period of Coverage

TSDF owners and operators must maintain financial assurance until closure and post-closure are complete. Within 60 days after receiving the owner or operator's and an independent registered professional engineer's certification of final closure, the implementing agency will notify the owner and operator that financial assurance for final closure is no longer required. Similarly, within 60 days after receiving these certifications of completion of post-closure care, the implementing agency will notify the owner and operator that financial assurance for post-closure is no longer required.

■ Accident Liability Requirements

TSDF owners and operators must also be able to compensate third parties for bodily injury or property damage that might result from hazardous waste management at a facility. This coverage ensures that, in the event of an accidental release of hazardous constituents, money will be available to compensate affected third parties suffering bodily injury or property damage. All TSDFs must demonstrate liability coverage for sudden accidents. In addition, TSDFs with land-based units (e.g., landfills) must also demonstrate liability coverage for nonsudden accidents.

Sudden Accidental Occurrences

The inherent risks posed by hazardous waste management at all TSDFs bring the possibility of sudden accidents. These **sudden accidental occurrences** are defined as events that are not continuous or repeated. Examples of sudden accidental occurrences are fires and explosions. The minimum financial requirements include at least $1 million per occurrence, and an annual total (known as annual aggregate) of at least $2 million.

Nonsudden Accidental Occurrences

Because land-based units are located directly on the land, they bring an increased risk of slow, long-term nonsudden leaks to soil and ground

water, and exposure to human health and the environment. These **nonsudden accidental occurrences** are defined as events that take place over time and involve continuous or repeated exposure to hazardous waste. An example of a nonsudden accidental occurrence is a leaking surface impoundment that contaminates a drinking water source over time. The minimum financial requirements include at least $3 million per occurrence, and an annual aggregate of at least $6 million.

These liability financial assurance coverage amounts apply on an owner and operator basis, not on a per facility basis. Consequently, owners and operators must provide $1 million per occurrence and $2 million annual aggregate for sudden accidental occurrences, and $3 million per occurrence and $6 million annual aggregate for nonsudden accidental occurrences (if applicable), regardless of the number of facilities owned and operated.

Period of Coverage

TSDF owners and operators must maintain financial liability coverage until closure is complete. Within 60 days after receiving a TSDF's certification of final closure, the implementing agency must notify the owner and operator that liability financial assurance is no longer required. Liability coverage is not required during the post-closure period. The implementing agency may, however, require liability coverage if closure was not completed in accordance with the facility's closure plan.

■ Financial Assurance Mechanisms

Financial assurance mechanisms are the different ways an owner and operator can show that funds are available to pay for closure, post-closure, and liability requirements. An owner and operator may demonstrate financial assurance through one or more of the following financial assurance mechanisms:

- Trust fund
- Surety bond (two types)
  - Payment bond
  - Performance bond
- Letter of credit
- Insurance
- Financial test
- Corporate guarantee.

Trust Fund

A **trust fund** allows a facility to set aside money in increments, according to a phased-in schedule (known as a pay-in period). At the end of this pay-in period, the facility will have enough money set aside to cover its financial assurance costs and will have funds specifically earmarked for closure, post-closure, and liability requirements.

Under some of the other mechanisms (surety bonds and letters of credit), owners and operators must establish a standby trust fund into which any payments made by the mechanism will be deposited. EPA will then use this trust fund to cover the respective costs.

Surety Bonds

A **surety bond** is a guarantee by a surety company that specifies that closure, post-closure, and liability obligations will be fulfilled. If the owner and operator fail to pay the costs specified in a bond, the surety company is liable for the costs. There are two types of surety bonds:

- **Payment bond** — A payment bond will, in the event an owner and operator fail to fulfill their financial assurance closure and post-closure obligations, fund a standby trust fund in the amount equal to the value of the bond. Payment bonds can also be used for liability.
- **Performance bond** — A performance bond guarantees that the owner and operator will comply with their closure and post-closure requirements. Performance bonds can also be paid into a standby trust fund. Interim status facilities may not use performance bonds.

Letter of Credit

A **letter of credit** is a credit document issued to a TSDF by a financial institution, covering the cost of closure, post-closure, or liability activities.

Insurance

The owner or operator of a TSDF may take out an **insurance** policy to cover the cost of closure, post-closure, and liability requirements in the event that the owner and operator is unable to satisfy these obligations.

Financial Test

Some companies are of such size and financial strength that they have the assets to absorb the costs of closure, post-closure, and liability obligations. As a result, owners and operators can demonstrate and document their financial strength by using the **financial test** to satisfy the TSDF financial assurance requirements.

Corporate Guarantee

While not all companies will be able to meet the financial test requirements, they may be owned by a company (or have a sibling company) that has the financial standing and ability to meet the financial test requirements. In these cases, a TSDF owner and operator may arrange a **corporate guarantee** by demonstrating and documenting that its corporate parent, corporate grandparent, sibling corporation, or a firm with a substantial business relationship with the owner or operator meets the financial test requirements on its behalf.

GROUND WATER MONITORING

The treatment, storage, or disposal of hazardous waste directly on the land creates the potential to generate hazardous waste leachate that can carry hazardous contaminants into the environment. Such contaminants can pose a serious threat to ground water resources.

Ground water is water found below the land surface in the part of the earth's crust in which all voids are filled with water. This water accumulates in an aquifer, an underground rock formation, that provides a significant amount of ground water to drinking wells and springs.

Ground water serves as a very important resource by providing drinking water and municipal water supplies for approximately 50 percent of all Americans. In some areas, ground water supplies 100 percent of the water supply for all uses. Ground water is also a very critical resource in agriculture. Farmers rely on this resource to irrigate the crops that are later sold at markets across the country.

The importance of ground water is highlighted by that fact that it is very difficult and expensive to clean once contaminated. Cleanup can take decades, and in certain cases cannot restore ground water to usable conditions.

■ General Requirements

In order to protect this valuable resource and avoid costly cleanups, RCRA requires TSDF owners and operators of land-based treatment, storage, or disposal units (i.e., land treatment units, landfills, surface impoundments, and waste piles) to monitor the ground water passing under their facilities to ensure that their hazardous waste management activities are not contaminating the ground water.

Waivers and Exemptions

Some land-based units are designed or managed in a way that does not bring the potential for ground water contamination. Such waivers or exemptions from the ground water monitoring requirements apply to:

- Man-made structures that do not receive liquid wastes, have inner and outer containment layers and a leak detection system between the containment layers, and are designed to prevent the entry of rain water
- Land treatment units that do not release hazardous constituents into the environment during the post-closure period
- Indoor waste piles
- Units that do not have the potential to leak hazardous waste into the environment
- Units that have been clean closed.

Ground Water Monitoring Provisions

The purpose of the ground water monitoring requirements is to require owners and operators of land-based units to monitor the ground water that passes beneath their TSDF in order to detect leaks

of hazardous waste, and facilitate cleanup as soon as possible. As a result, owners and operators must install monitoring wells to detect contamination in the aquifer nearest the ground surface. In order to ensure that the information received from the monitoring wells is accurate, TSDF owners and operators must have:

- Enough wells installed in the right places to accurately represent the ground water activity under the facility
- Properly installed wells (poorly installed wells may give false results)
- Lined or cased wells to prevent the collapse of monitoring well bore holes
- Consistent sampling and analysis procedures
- Statistical methods to avoid false evidence of a release
- Accurate records containing any information collected.

The ground water monitoring requirements vary for permitted and interim status TSDFs. The interim status ground water monitoring requirements are designed to generate information about ground water quality for use in developing the facility's permit, as well as detect and clean up releases.

■ Permitted Facilities

Facilities with permitted land treatment units, landfills, surface impoundments, or waste piles must develop a ground water monitoring program. This ground water monitoring program consists of three phases:

- Detection monitoring, to detect if a leak has occurred
- Compliance monitoring, to determine if an established ground water protection standard has been exceeded once a leak has occurred
- Corrective action, to clean up contamination caused by the leak.

Because different TSDFs handle different types of wastes and will have units of different age and design, each TSDF's program is unique and site-specific.

Detection Monitoring Program

Detection monitoring is the first step of ground water monitoring. The goal is to detect and characterize any leaks of hazardous waste from the unit. The owner and operator compares the results from the sampling wells to the background groundwater levels to determine if there is any evidence of an increase over background levels (see Figure III-9). An increase from the background levels might indicate a leak from the unit. If evidence indicates that the unit is leaking, the owner and operator must:

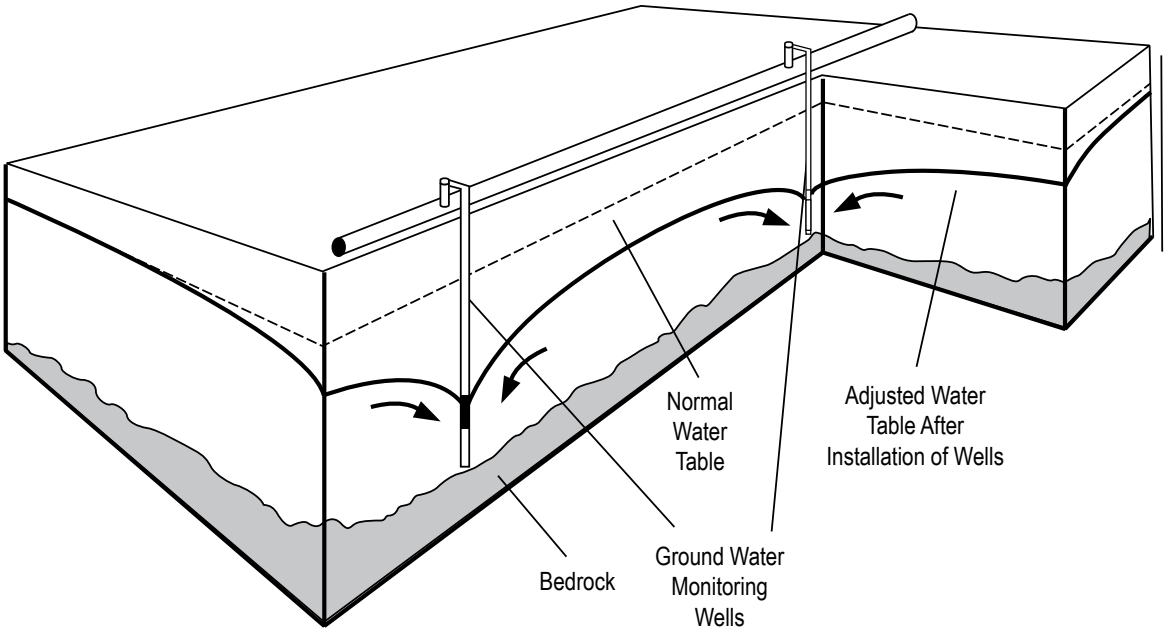
- Notify the EPA Regional Administrator within seven days
- Immediately sample all wells for hazardous constituents
- Determine which hazardous constituents are present and at what levels
- Submit an application to modify the facility's permit to move into the second phase of the ground water monitoring program (compliance monitoring)
- Submit a cleanup feasibility plan.

If the owner and operator can prove that the contamination did not result from their facility, they can continue detection monitoring.

Compliance Monitoring Program

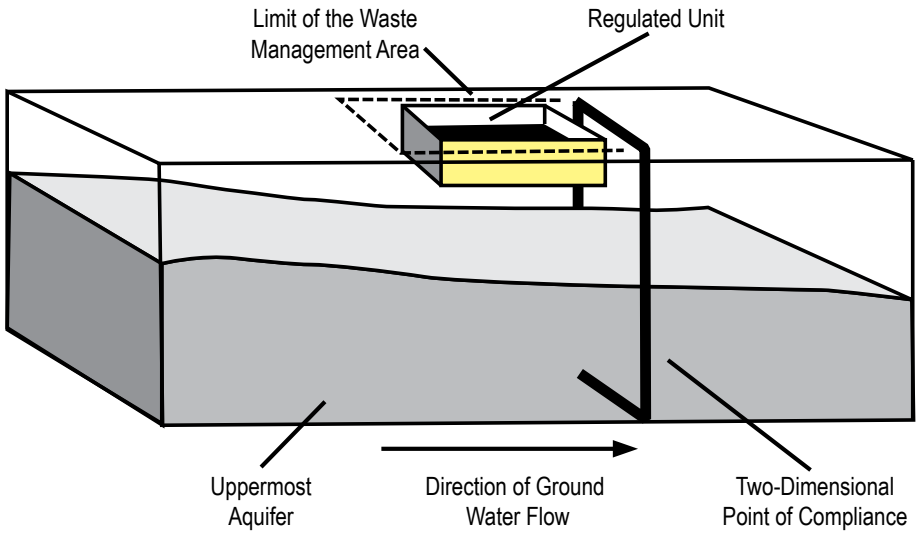
Once the owner and operator has established that a release has occurred, they must develop and implement a **compliance monitoring** program (see Figure III-10). The goal of compliance monitoring is to ensure that the amount of hazardous waste that has leaked into the uppermost aquifer does not exceed acceptable levels. In order to determine what these acceptable levels are, RCRA requires the owner and operator to establish a ground water protection standard (GWPS). The GWPS has four parts: identification of hazardous constituents; identification of concentration levels for each constituent; establishment of a compliance point;

Figure III-9: Detection Monitoring



In detection monitoring, owners and operators compare the sample results from the ground water monitoring wells to the background water quality levels. A change from background levels might indicate a leak from the unit.

Figure III-10: Compliance Monitoring



During the compliance monitoring program, an owner and operator must ensure that the amount of hazardous waste that has leaked into the uppermost aquifer does not exceed acceptable levels. To achieve this, an owner and operator must establish a ground water protection standard, which includes identification of hazardous constituents, identification of concentration levels for each constituent, establishment of a point of compliance, and determination of a compliance period.

and determination of a compliance period during which the GWPS applies.

Hazardous Constituents

For purposes of compliance monitoring, **hazardous constituents** are those constituents that have been detected in the uppermost aquifer and are reasonably expected to be in or derived from the waste contained in the unit.

Concentration Limits

Concentration limits are the maximum levels of hazardous waste or hazardous constituents allowed to be present in the ground water. The concentration levels can be:

- Background levels
- **Maximum contaminant levels (MCLs)** borrowed from SDWA
- **Alternative concentration limits (ACLs)** established by the EPA Regional Administrator.

Point of Compliance

The **point of compliance** is the vertical point where the owner and operator must monitor the uppermost aquifer to determine if the leak exceeds the GWPS.

Compliance Period

The compliance period is the length of time during which an owner and operator must conduct compliance monitoring or perform cleanup. Generally, this period will cover the rest of the TSDF's operating life and may extend into the post-closure period.

The owner and operator must monitor at least semiannually to determine if the GWPS has been exceeded. The specifics of the GWPS will be listed in the TSDF's permit.

During the compliance period, the owner and operator must determine whether there is any evidence of increased contamination for any of the hazardous constituents specified in the GWPS. This is accomplished by comparing information collected at the point of compliance to the concentration limits set in the GWPS. The owner and operator must also analyze the samples from compliance wells for all RCRA hazardous constituents at least annually to determine if any additional constituents are present that are not specified in the GWPS. If additional constituents are found, they must be added to the list of constituents in the GWPS.

If the GWPS is exceeded, the owner and operator must:

- Notify the EPA Regional Administrator in writing within seven days
- Submit an application to modify the facility's permit to move into the third phase of the ground water monitoring program (corrective action)
- Continue to monitor in accordance with the compliance monitoring program.

If the owner and operator can prove that the increased contamination resulted from a source other than their facility, or that the increase was due to an error in analyzing the sample or natural variations in ground water, they must notify the EPA Regional Administrator in writing within seven days. On the other hand, if the contamination is found to have resulted from a unit at the TSDF, the owner and operator must initiate cleanup.

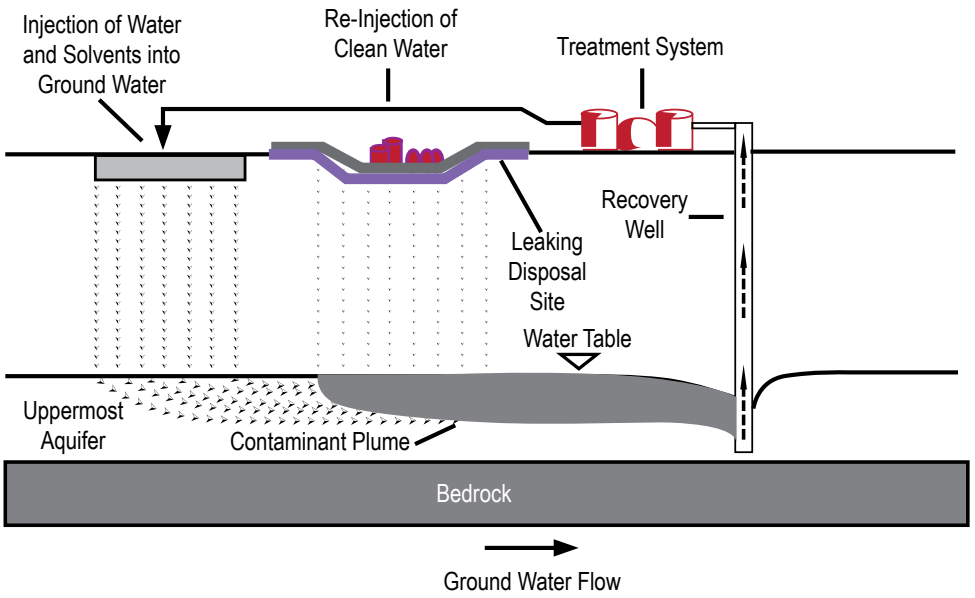
Corrective Action Program

The goal of ground water corrective action (cleanup) is to clean the ground water to meet the GWPS. To clean up the contamination, the owner and operator must either remove the hazardous constituents from the ground water or treat them in place. The specific measures undertaken to clean the ground water will vary with each facility (see Figure III-11).

Effectiveness

To make sure the owner's and operator's corrective action program is working properly, they must monitor the ground water under the TSDF, and then report semiannually on the effectiveness of the corrective action program.

Figure III-11: Ground Water Corrective Action



An example of ground water corrective action is a ground water pump and treat system. In order to remediate contamination that has leaked from a disposal site into the uppermost aquifer, the owner and operator injects water and solvents into the ground. The groundwater flow carries the water and solvents to the contaminant plume, flushes the plume of the contamination, and carries the contaminants to a recovery well where the contaminated water is pumped to the surface and treated. Clean water is then re-injected into the ground water for reuse in the pump and treat process.

Time Period

Once the ground water has been treated to meet the GWPS, the owner and operator may stop corrective action and return to compliance monitoring. During the compliance period, facilities may move between compliance monitoring and corrective action as necessary to respond to new releases from the unit.

If the compliance period ends and corrective action is still being conducted, corrective action must continue as long as necessary to achieve the GWPS. Only after the owner and operator has met the GWPS for three consecutive years may they stop corrective action. If the unit is still in the post-closure period, the owner and operator may then reinstate a detection monitoring program. If the post-closure period has elapsed, the TSDF has completed its requirements under RCRA ground water monitoring.

■ Interim Status Facilities

The requirements for interim status facilities were designed to supply background data on these facilities before permitting, and to act as a warning system to detect any releases to ground water prior to issuing a permit to the facility. The interim status program is similar to the permitted ground water monitoring program, but does not include cleanup provisions. If cleanup is required at an interim status facility, it will be addressed under RCRA §3008(h) or §7003 corrective action authorities (as discussed in Chapter III, Corrective Action to Clean Up Hazardous Waste Contamination), or in the facility permit when issued. The interim status ground water monitoring program is comprised of two phases: an indicator evaluation and a ground water quality assessment.

Indicator Evaluation

To determine if the units at a TSDF are leaking, the owner and operator must monitor the ground water under the facility. The information collected from the monitoring wells is compared to data on background water quality to determine

if any contamination of the uppermost aquifer has occurred. If the information indicates that there may be a release from the facility, the owner and operator must then begin the second phase, the ground water quality assessment. If an owner and operator assumes or already knows that contamination of the uppermost aquifer has occurred, they may initiate the ground water quality assessment instead of an indicator evaluation program.

Ground Water Quality Assessment Program

Once the owner and operator has determined that there may have been a release from the unit, the ground water quality assessment helps to determine the extent of the release. If an owner and operator must perform a ground water quality assessment, they must notify the EPA Regional Administrator within seven days, and prepare and submit a plan on how to conduct a ground water quality assessment to the EPA Regional Administrator within 15 days. In the ground water quality assessment, the owner and operator must establish how fast the unit is leaking, how far the leak has spread, and the concentrations of constituents in the contamination. The owner and operator must repeat this assessment at least quarterly until final closure of the facility, and must keep records of all required analyses and evaluations on site. They must also submit an annual report to the EPA Regional Administrator detailing the status of the ground water quality assessment program.

AIR EMISSION STANDARDS

While many hazardous waste TSDF standards are designed to protect ground water, potential contamination of air resources also represents a threat to human health and the environment. During the process of hazardous waste treatment, storage, or disposal, hazardous constituents can escape into the air.

One particular class of these constituents, volatile organics, evaporate easily and have been linked to several adverse health effects. In order to control the release of these emissions from hazardous waste management processes, RCRA imposes air emission control requirements on units that commonly manage hazardous waste with organics.

■ Process Vents

Certain types of hazardous waste units are commonly used to manage wastes with high levels of volatile organics. As a result, the first set of air emission requirements addresses **process vents** associated with the distillation, fractionation, thin-film evaporation, solvent extraction, and air and steam stripping of hazardous waste with an annual average total organic concentration of 10 parts per million by weight (ppmw). Owners and operators of TSDFs with these treatment processes must reduce organic emissions from affected process vents at their entire facility. To meet this standard, the owner and operator may either modify the treatment process or install a device to control organic emissions.

■ Equipment Leaks

Volatile organics can also escape into the air through gaps between connections of hazardous waste management **equipment**, or other leaks from such equipment. As a result, the second set of air emission regulations establishes specific leak detection and repair programs for equipment (e.g., valves, pumps, and compressors) that contains or contacts hazardous waste with at least 10 percent by weight organics. These programs require leak detection monitoring and inspection. In addition, once a leak has been detected, the equipment must be repaired.

■ Tanks, Surface Impoundments, and Containers

In order to further protect human health and the environment from the risks posed by volatile organics, the final set of RCRA air emission standards require TSDF owners and operators to control organic air emissions from hazardous waste tanks, surface impoundments, and containers. RCRA requires these controls if the units manage waste with an average volatile organic concentration above 500 ppmw. These air emission controls prevent the release of organic constituents through installation of a control device (e.g., a flare), or prevention of emissions.

Tanks

TSDF tank owners and operators are subject to one of two different sets of requirements depending on the vapor pressure of the waste being managed in the unit. Tanks which store hazardous waste below certain vapor pressures (known as Level 1 tanks), must be equipped with, at a minimum, a fixed roof. Those tanks that store waste with higher vapor pressures (known as Level 2 tanks), have five compliance options that range from putting the tank in an enclosure vented to a control device to using a closed-vent system that vents emissions from the unit to a control device.

Surface Impoundments

TSDF surface impoundment owners and operators must either install a cover (e.g., an air-supported structure or a rigid cover) over the impoundment, which must be vented through a closed-vent system to a control device, or equip the surface impoundment with a floating membrane cover.

Containers

TSDF owners and operators are subject to one of three different sets of requirements for containers depending on the size of the container, the organic content of hazardous waste placed in the container, and whether or not waste stabilization (as discussed in Chapter III, Land Disposal Restrictions) occurs in the container. Small containers (between $0.1m^3$ and $0.46m^3$) and large containers (greater than $0.46m^3$) storing waste with a low vapor pressure (known as Level 1 containers) must either comply with DOT requirements, be equipped with a closed cover, or be fitted with a vapor suppressing barrier. Large containers storing waste with a high vapor pressure (known as Level 2 containers) may either meet DOT specifications, operate with no detectable emissions, or be vapor tight (i.e., no vapors can escape the unit). The last category of containers (Level 3 containers) are those units conducting waste stabilization. These containers must be vented through a closed-vent system to a control device.

■ Other Requirements

The air emission standards require owners and operators to keep certain records demonstrating compliance with these standards in the facility's operating log.

LQGs are subject to the interim status air emission control requirements for process vents, equipment leaks, containers, and tanks. SQGs, however, are not subject to these air emission control requirements.

SUMMARY

The RCRA Subtitle C TSDF standards impose requirements on units that treat, store, or dispose hazardous waste. These standards include full operation and management requirements for permitted facilities (those built after the standards were established) and less stringent provisions for interim status facilities (those that were already in operation).

The TSDF standards require facilities to comply with:

- General facility standards
- Preparedness and prevention requirements
- Contingency plans and emergency procedure provisions
- Manifest, recordkeeping, and reporting requirements.

TSDF owners and operators can treat, store, or dispose of waste in a variety of units. Each unit has its own specific standards governing unit design, construction, operation, and maintenance. Owners and operators can manage their waste in any of the following units:

- Containers
- Containment buildings
- Drip pads
- Land treatment units
- Landfills

- Surface impoundments
- Tanks
- Waste piles
- Miscellaneous units.

LQGs accumulating waste in containers, containment buildings, drips pads, and tanks are subject to the interim status TSDF standards for these units. SQGs accumulating waste in containers and tanks are subject to the interim status standards for these units.

The TSDF standards also establish requirements to ensure that hazardous waste management units are closed in a manner that protects human health and the environment. The closure provisions require the facility to stop accepting waste; remove all waste from management units; and decontaminate all soils, structures, and equipment. Some units (i.e., land treatment units, landfills, and surface impoundments) serve as places for the final disposal of hazardous waste. These land disposal units must comply with additional post-closure requirements to ensure proper long-term unit maintenance.

Because closure and post-closure activities can be very expensive, the TSDF standards require owners and operators to demonstrate financial assurance. These provisions also require all TSDFs to set aside funds in order to compensate third parties for bodily injury and property damage that might result from hazardous waste management operations.

RCRA's TSDF standards also include provisions to protect ground water and air resources from hazardous waste contamination. RCRA requires owners and operators of land-based units (i.e., land treatment units, landfills, surface impoundments, and waste piles) to monitor the ground water below their TSDF for possible contamination, and clean up any discovered contamination.

In order to protect air resources, TSDFs are required to install unit controls to prevent organic emissions from escaping into the air. The air emissions controls apply to process vents, equipment leaks, containers, surface impoundments, and tanks.